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Transportation, Physical Services and Land Use

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The Regional Chairman's Task Force on
Sustainable Development


by

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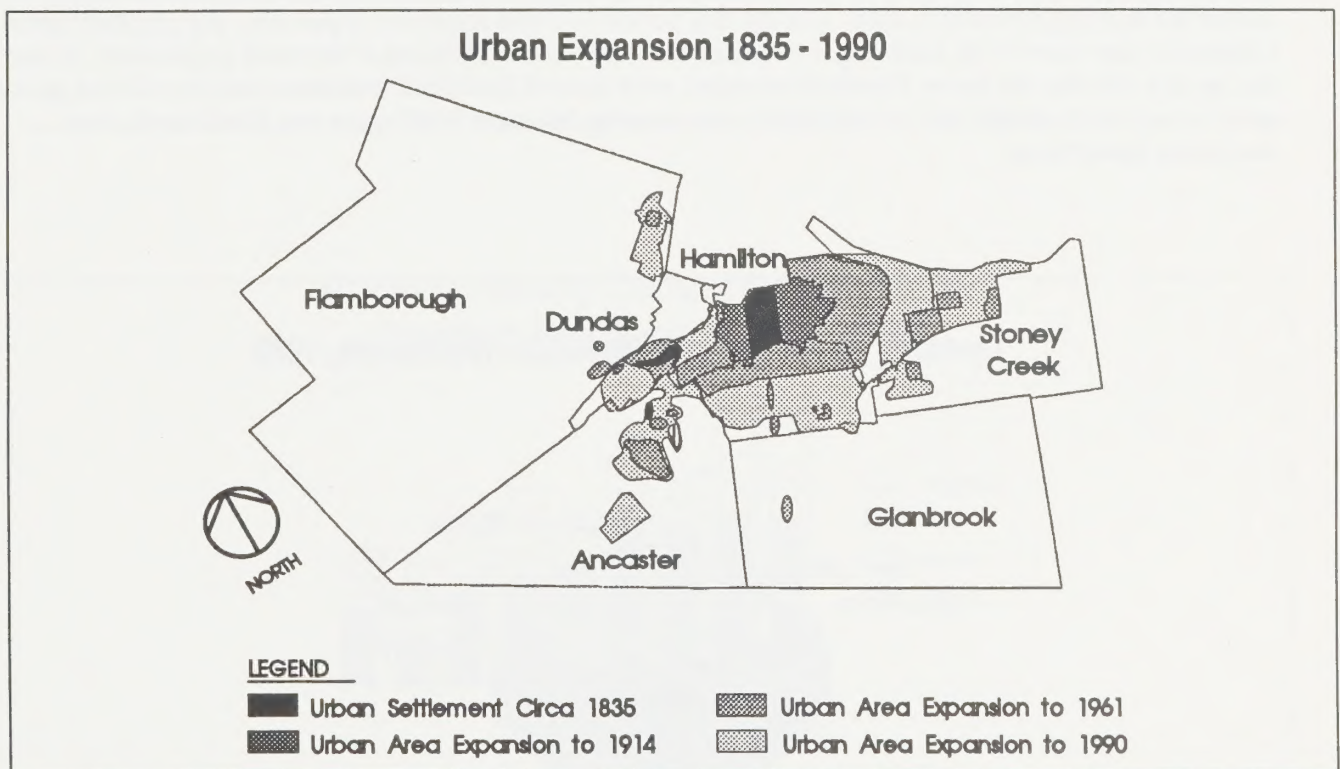
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1 General Trends in the Geographic Expansion of Urban Areas in Hamilton-Wentworth

To a large extent, the physical form of existing urban areas in the Region merely reflect the economic and transportation systems of the era in which a building, city block, or subdivision was constructed. In the Hamilton, Dundas, and Ancaster, Waterdown, and Stoney Creek the older elements of the urban form reveal a far more compact and pedestrian nature than the newer, more "modern" developments. Of the early and mid-nineteenth century period, only small remnants remain, generally clustered in the central area of Hamilton or in the old town areas of Dundas or Ancaster.

Most of the heritage of this period can be found in the layout of the downtown and adjoining areas in the City of Hamilton, where streets are still relatively narrow and development quite dense. In some places, such as on James, King William, Duke and King Streets, the closely-packed two, three and four storey buildings lining the streets reveals the dense, compact, and heterogeneous nature of the 19th Century City. During that period urban residents walked virtually everywhere, and worked, shopped and lived within several square miles in the same town or district. Only a small minority of wealthy businessmen, landowners and professionals could afford to travel extensively outside of the compact urban areas of the time. Although these older districts of Hamilton now have paved roads and excellent urban services, during the 19th Century the roads were unpaved, contained open sewers and were hardly conducive to rapid transportation. Most industrial enterprises were interspersed in an unpatterned distribution throughout the old city, with only certain forms of manufacturing requiring specific types of geographical locations (boat building, water-powered operations, etc).



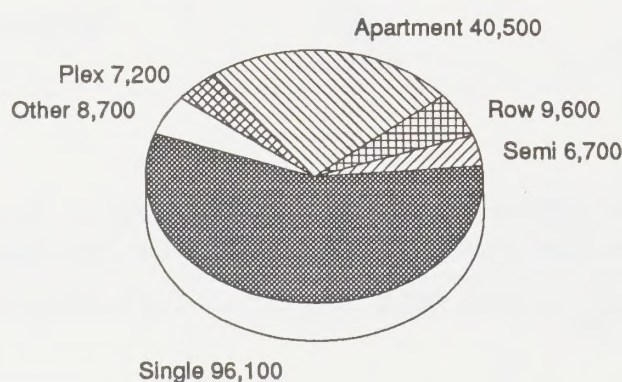
Source: Hamilton; An Illustrated History, John Weaver, Toronto, 1982, pg. 12 & pg. 102, Hamilton Area Transportation Plan, City of Hamilton, 1963, Land-Use Maps, Hamilton-Wentworth Planning Department, 1990

Towards the turn of the century, Hamilton began to be transformed by a revolution in urban services and transportation, and an evolution towards a heavy industrial economy that was altering the American northeast and southern Ontario. Differentiation of land-uses between residential and industrial activities became more common in the late 19th Century as heavy industry located in the northern and north-eastern parts of the city to take advantage of the newly-navigatable harbour, and new homes were produced on a street-by-street, mass-production basis to the east of the city in a way that would have been unimaginable only a few decades before. Densities declined rapidly as public transportation and commuting became the norm rather than the exception. In the 1870s horse-drawn cars began to transport workers to their places of employment, and in the early 1890s electric street cars started an era of low-density development that depended on mechanical-vehicle transport.

In terms of land-use and transportation, the two most important phases in the evolution of the urban form that exists today were the 1890 to 1914 period and the post-World War Two period. During the turn-of-the-Century era electric street car expansion, the rapid growth of the heavy industrial complex in the Bayfront area, and the dramatic improvement of railroad and canal facilities in the Great Lakes region, largely established the land-use character of the City of Hamilton below the escarpment up until the present time. Transportation facilities provided by the numerous upgrades of the Welland Canal and the harbour facilities, as well as by the Toronto, Hamilton and Buffalo Railroad, permitted heavy industries such as Dofasco (Dominion Steel Foundaries), Stelco (Steel Company of Canada), International Harvester, Otis Elevator and National Steel Car to become established in the Bayfront area before the First World War. Abundant and cheap hydro-electric power also played a strong role in attracting industries to Hamilton, and Hamilton's strategic location quickly established it as one of Canada's largest urban areas.

Residential development promoters worked in conjunction with the street car services to open up new housing for industrial workers, leading to the first wave of urban sprawl in what is today Hamilton-Wentworth. Although the 1890 to 1914 period saw the opening of two inclined railways, transportation and services up and above the escarpment remained rudimentary at best, forcing urban expansion largely to the east of the existing downtown area. During this period of rapid economic expansion, the city itself grew at a dramatic rate, more than doubling in physical size and almost doubling in terms of population. It was during this era that the lower Hamilton of today, with its vast industrial structures and foundaries in the north along the Bayfront, and its residential row-housing between Wellington and Kenilworth, was essentially established.

Dwelling Units by Type, Hamilton-Wentworth, 1988



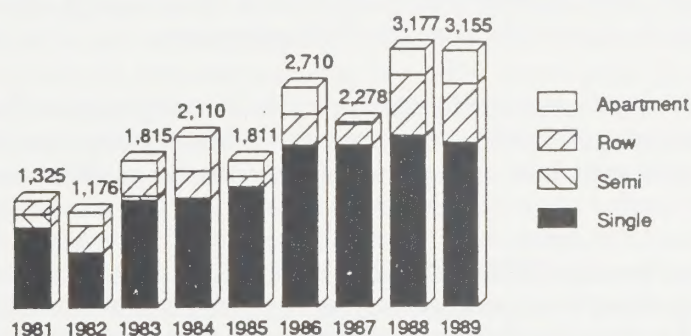
Source: Ministry of Revenue, Assessment Division and Hamilton-Wentworth Planning and Department, Municipal Building Profile

The First World War, the booming twenties, the Depression of the 1930s, and the Second World War, all had impacts on the development of Hamilton's land-use patterns and transportation, but the style and density of development did not change substantially from that established in the 1890 to 1914 period. Although automobiles began to become a major force in transportation development in the 1920s and 1930s, the workforce remained tied to mass-transit as a means of commuting to their places of employment, and newly constructed houses were relatively small by today's standards. Although development had begun to take place above the escarpment in the 1920s, transportation linkages were inadequate and the high cost of urban services "on the Mountain" made large-scale development there a unfeasible proposition.

It was during the post-World War Two housing boom that the Hamilton-Wentworth area underwent another major transformation. Immediately following the war, Hamilton expanded rapidly above the escarpment, as a result of extensive road and highway construction and the growth in automobile ownership amongst the working and middle classes. Between 1946 and 1951 alone, the population of Hamilton above the escarpment doubled, causing a dramatic southward expansion of the city.

During the postwar period urban development continued at a relatively steady pace, in upper Hamilton, Dundas, Stoney Creek, Ancaster and Waterdown. The planning and construction of highways in southern Ontario accelerated to such a rapid pace that by the early 1960s virtually all of the major highways now used in the Hamilton-Wentworth were completed or under construction. An expressway up the Redhill Creek linking the QEW and the 403 via Hamilton above the escarpment, and the 403 extension to link the 403 in Mississauga with the 403 in Hamilton, were both detailed in transportation plans that were published in 1963. Those highways built in the 1950s and early 1960s, along with the grid road established in upper Hamilton, effectively established the transportation blueprint that would be utilised as the basis for residential and industrial development in the 1965 to 1990 period.

Annual Housing Completions by Type
Hamilton-Wentworth, 1981-1989



Source: CHMC Local Housing Market Reports, 1981 to 1989.

2 Development Densities and Urban Design Issues, 1945-1990

Land-use patterns, particularly those of residential areas, tend to reflect a broad array of social, economic and design factors that change gradually from year to year, and decade to decade. For many years before the First World War, the average resident of Hamilton could not even conceive of owning his or her own house, let alone a 2000 square foot home on a 40 foot lot. It was only the advent of the electric streetcar, and the development of row after row of worker housing in east Hamilton, that homeownership became a realistic possibility for the average urban labourer.

Prior to the Second World War, people in Hamilton held a radically different perception of the home and household than that held in the postwar period. Homes were built so that a boarder or two could be accommodated to provide badly-needed extra revenue, and lot sizes within urban areas were quite limited in size. Population densities of any given new development were usually quite high by the standards of today, reflecting a need to build functional neighborhoods that could be served by mass-transit rather than by the automobile. Homes had to be a short distance by foot from major streetcar routes and were almost invariably near to commercial strips along major roads that provided ample shopping opportunities. Even when electric street cars had liberated workers from having to live within walking distance of their place of employment, residential neighborhoods still tended to be located within easy walking distances of all of the amenities normally associated with urban living. Shops, markets, taverns, and professional services still congregated in pedestrian areas along major streets in residential areas. A reliance on walking as the major form of transportation combined with the relatively-high cost of providing running water, covered sewers and paved roads imposed limits on the geographical extent of urban development.

The automobile ownership explosion of the late 1940s, 1950s and 1960s permitted potential homeowners to locate far from mass-transit routes and shopping facilities. A new standard of lot size evolved in the early post-war period as people began to demand lots that resembled those in semi-rural areas, and recreational facilities not easily found in traditional dense urban areas of the pre-1945 period. The size of houses increased during the early postwar years, but not as greatly as the increase in the size of lots. In the 1945 to 1960 period, developers and homebuilders stopped building small, closely-packed homes in lower Hamilton and started building small homes on large lots above the escarpment.

In fact, ownership of a house with a large lot and automobile ownership were relatively symbiotic functions during the late 1940s and 1950s in Hamilton (although the trend had actually begun during the first car-ownership boom of the 1920s), since a car was often necessary to travel to a large-lot home, and since a large-lot home was often required to be able to park an automobile. By lowering densities and thus reducing the geographic demand for retail functions, the ownership of cars only increased the new tendency to drive to large suburban retail outlets that provided ample parking facilities. Thus, the development of suburban retail strips and then suburban shopping malls in the 1950s and 1960s only further reinforced the implicit requirement for an automobile in newly developing areas.

Although lot sizes saw a drastic increase in size during the housing boom of the late 1940s and 1950s, increasing affluence caused the inhabitants of Hamilton to demand larger and larger houses in the post-1960 era rather than larger and larger lots. Assessment records of existing structures indicate that homes built during the 1900 to 1945 period can be roughly broken down into two almost equal divisions, one of single-detached lots of 3,000 and less square feet in size (53.1 percent of the total), and one of single-detached lots of greater than 3,000 but less than 7001 square feet in size (43.5 percent of the total). It is apparent, however, that single-detached-dwelling lot sizes on average were much greater after the Second World War, with the vast majority of houses built in Hamilton between 1945 and 1988 having lot sizes of between 3,000 and 7,001 square feet. Of existing houses built between 1946 and 1960, 82.7 percent have lot sizes ranging from 3,000 to 7,001 square feet, while for houses built between 1981 and 1988 the comparable figure is 86.5 percent.

The most apparent change in residential urban design trends in the postwar period, if not in average lot size, was in the size of the average house built. The construction of compact, simple, under-1,000-square-foot starter homes for hundreds of thousands of returning soldiers, gradually gave way to the four-bedroom, over-2,000 square foot dwelling now common in new suburban areas. Assessment records indicate that approximately 35 percent of single-detached homes built between 1946 and 1960 were under 1,000 square feet in size. This percentage dropped to 9.7 percent for homes built between 1961 and 1970, to 5.4 percent for homes built between 1971 and 1980, and then plummeted to the minute level of 0.6 percent of all homes constructed between 1981 and 1988. On the other hand, homes of greater than 2,000 square feet made up only 2 percent of the total built in the 1946 to 1960 period, but constituted over 37 percent of the homes constructed between 1981 and 1988.

This trend was also mirrored in the outlying suburban municipalities, which evolved from satellite communities into full-fledged integrated suburban bedroom communities during the post-war years. In these communities, such as Stoney Creek and Ancaster, single-detached lot size tended not to increase during the 20th Century period because these areas were originally semi-rural and already had above-average lot sizes during the 1900 to 1945 period. However, Ancaster and Stoney Creek, just like Hamilton, showed a marked increase on a decade by decade basis of the size of houses being constructed. In Stoney Creek, for instance, single-detached houses of under 1,000 square feet constitute over 22 percent of the houses built in the 1946 to 1960 period, and less than 1 percent of all houses built between 1981 and 1988. Ancaster, always a more affluent area, saw a decline in the construction of houses of less than 1,000 square feet from approximately 7 percent of the total between 1946 and 1960 to less than 1 percent of those built in the 1981 to 1988 period.

In fact, the acceleration in the growth of single-detached homes in the outlying areas of Hamilton-Wentworth was even more pronounced than in Hamilton itself. In Ancaster, less than 7 percent of the single-detached homes built between 1946 and 1960 were greater than 2,000 square feet in size, while during the 1981 to 1988 period over 87 percent of the houses constructed were over 2,000 square feet in size. In Stoney Creek, the percentage of single-detached homes of over 2,000 square feet in size shot up from only 3.3 percent of the total built between 1946 and 1960 to over 45 percent of the total built between 1981 and 1988. Thus, large homes have become the norm rather than the exception for new construction. Of the 5,948 single-detached homes built in the Region between 1986 and 1988, 3,078 were over 2,000 square feet in size, while only 11 were under 1,000 square feet in size.

Possible reasons for this rapid growth in average home size but relative stability in average lot size are numerous. Lot sizes probably have not increased as the result of the Regional and Area Municipalities passing on most of the cost of urban expansion in the form of development charges to the purchasers of new homes, since larger lot sizes imply increased servicing and infrastructure costs. Other factors that could have restrained the growth of lot size in Hamilton-Wentworth would include the standardisation of lot sizes permitted under zoning regulations, increasing scarcity of readily-developable land, and a decline in the demand for large lots by potential purchasers. It is interesting to note, for instance, that even though average home size has been increasing at a much faster rate than the average lot size, that the cost of lots as a percentage of the total cost of the completed new house has been increasing since the 1970s.

Even though the construction of single-detached homes has dominated the real estate development industry in Hamilton-Wentworth for the past half century, higher density forms of housing such as row housing and apartments have also played a major role in providing shelter to residents of the Region. However, unlike the development of new detached houses, which has continued on at a relatively steady pace (at least by real estate standards), the development of high density housing units has been marked by severe fluctuations in construction trends. Current assessment data shows that of the existing housing stock in the region, the vast majority of units (approximately 82 percent) built between 1945 and 1960 were single detached homes. (figures for total housing units do not include farm residences)

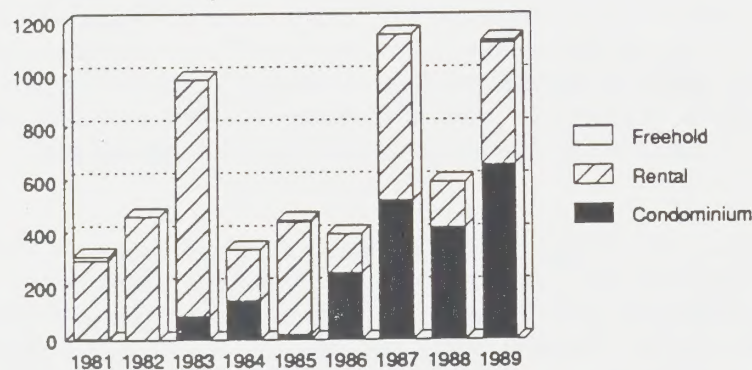
The 1960s and 1970s saw a marked increase in the construction of rental apartments, particularly adjacent to the central business district in Hamilton. Many of these apartment buildings were large, multi-story structures that greatly increased the population densities in a number of lower Hamilton neighborhoods and along major arteries in upper Hamilton and Stoney Creek, and the rapid increase in population combined with the destruction of historic buildings caused an outcry over the magnitude of change to neighborhood character. Development of large-scale apartment buildings slowed during the late 1970s, and by the 1980s construction of large-scale rental apartment buildings had fallen to much lower levels.

Data for existing structures shows that of those dwelling units built in the 1946 to 1960 period, less than 15 percent were rental apartment units. The situation changed dramatically in the 1960s, when rental apartment units comprised almost 53 percent of the housing units constructed during that decade, and this trend continued in the 1970s, when almost 42 percent of the total housing units built were rental apartment units. Other types of high-density housing units, such as condominium and freehold row structures, also were built in great numbers in the 1970s, reflecting a movement towards provision of housing for non-traditional households.

During the 1980s this trend towards higher density living was completely reversed, and the percentage of total housing units built as rental apartment housing fell to 8.1 percent for the 1981-86 period and 7.3 percent for the 1986-88 period. Single detached homes constituted only 32.7 percent of the housing units built in the 1970-80 period, but records show that single detached homes accounted for almost 78 percent of the total housing units built between 1986 and 1988. Reasons for this transition away from high density housing production may include the introduction of Provincial rental controls, changing regional demographic characteristics, and increasing local opposition to the construction of large apartment buildings in low density neighborhoods.

During the 1980s, one of the most striking changes in housing unit construction trends (in addition to the reversion to the building of single detached dwellings) was the growth in the construction of condominium row and apartment units, particularly as a percentage of total row and apartment construction. This trend may reflect the rapidly escalating cost of building standard single-detached dwellings relative to inflation during the 1980s, a lack of new rental apartment units on the market because of rental controls, and a desire on the part of developers to build a type of high-density dwelling that could be sold off immediately by the unit to the public.

Row and Apartment Starts by Tenure
Hamilton-Wentworth, 1981-June 1989



Source: CHMC | Local Housing Market Reports, 1981 to 1989.

New industrial subdivisions, too, were increasingly developed in a less-dense manner during the post-World War Two period. The rapidly-growing light manufacturing, distribution and warehousing sectors in particular were attracted to suburban industrial parks across North America in the 1960s, 1970s and 1980s as heavy industries in central urban areas went into decline and stopped expanding. High-technology, light assembly and storage activities all have tended to demand substantial quantities of land and one-or-two story structures free of internal building supports, as well as abundant parking spaces for employees.

During the 1970s and 1980s, a new more sophisticated form of industrial park, usually called an office or business park, has also evolved, which is distinguished from regular industrial parks by a much higher percentage of office and commercial uses as well as high-quality landscaping and "parklike settings". Like newer industrial parks, these business and office parks depend almost totally on nearby highways and major arteries to bring supplies (by truck) and employees (by car) to the businesses within them. For this reason, excellent road access is a major determinant of a new industrial or business parks survival. In Hamilton-Wentworth the transition from dense, centralized heavy-industrial areas near port and railway facilities to low density, suburban, light manufacturing and distribution centres found near major highways and arteries, is evident in the contrast between the older Bayfont Industrial Area and the rapidly expanding Industrial-Business Parks found in Stoney Creek, Ancaster, and Hamilton Mountain.

Retailing, too, has seen a dramatic shift in basic urban design characteristics; street-front, family-owned retailing has seen a great deal of decline, particularly in certain older parts of Hamilton, while suburban mall and strip retailing have expanded at a rapid pace. The most recent trend in retailing appears to be the spread across North America of warehouse-type retailing and part industrial-part retail operations that locate in industrial or business parks, or along major highways. Hamilton-Wentworth has been affected by this trend, and newer industrial parks such as Hamilton Mountain IBP and Stoney Creek IBP have a substantial number of retail and commercial businesses operating amongst more standard forms of warehousing and light manufacturing. Even in Hamilton's city center, street retail is giving way to mall development; the Eaton center has just added a large amount of retail space to the downtown area at the same time as many street retailers were already having a hard time with the recession and competition from U.S. retailers. From a transportation perspective, the development of large suburban malls, and pseudo-retail in business and industrial parks is important because it further strengthens the role of automobiles as the primary form of transportation in the Region.

3 Current Municipal Plans For Future Urban Expansion

Most ongoing residential and industrial subdivision development in urban areas is now taking place in the southern-most edge of Hamilton below Limeridge Road, in Stoney Creek, in Waterdown, and in Ancaster. Within the urban areas defined by Hamilton-Wentworth's Official Plan, each municipality has been permitted to expand its urban residential and industrial areas by a substantial margin according to that municipality's specific land-use policies. Market forces have dictated, however, that urban expansion take place in the aforementioned locations. Hamilton and Dundas are largely built out, and Ancaster, Stoney Creek and the Waterdown area of Flamborough now contain most of the land that will be developed in the next ten years, since highway access to Glanbrook and most of Flamborough from major employment areas is restricted and municipal servicing in these areas is severely limited.

There are approximately 1,950 hectares (4,880 acres) of vacant residential land with a development potential of just under 47,000 dwelling units in designated urban areas in Hamilton-Wentworth. This represents an estimated 15-20 year supply of land, based on recent development trends and current household growth forecasts contained in the Planning and Development Department's "Hamilton-Wentworth Population Projections, 1988-2006". Roughly 51 percent of the land is serviced (able to connect to existing main trunk lines) and another 34 percent will likely receive water and sewer trunk lines within five years.

Land designated for single detached units represent 84 percent of vacant residential land in the Region. However, due to the lower density of single detached development, this land would accommodate only 59 percent of all of the future units. Land designated for multiple units represents 10 percent of the vacant land and would accommodate 19 percent of total future units. Land designated for apartments represents 5 percent of the land supply and would accommodate 21 percent of future units. The remaining land is designated for semi-detached dwellings.

The amount of vacant residential land and the estimated unit potential vary by municipality. Thirty-six percent of the total supply of vacant residential land and 38 percent of the potential units are located in the City of Hamilton. Stoney Creek also has a relatively large proportion of vacant residential land (25 percent) and potential units (31 percent). The higher proportion of potential units in Stoney Creek reflects, in part, plans for higher density development along the waterfront.

Ancaster contains 18.5 percent of the vacant residential land in the Region, but the estimated unit potential is only 15 percent of the estimated unit potential for the Region. This reflects plans for lower density development in this municipality. Dundas, Flamborough and Glanbrook contain the remaining 20 percent of the Region's available land supply and 16 percent of the estimated unit potential.

There is also an abundant supply of land designated for industrial uses in Hamilton-Wentworth. Virtually all of available industrial land (3,240 acres) is found in the industrial-business parks that are designated in the Regional Official Plan, with only approximately 134 acres of vacant industrial land available in the Region's established industrial areas. Based on the 1980-90 absorption rates, there is a 57 year supply of industrial land available in Hamilton-Wentworth. Each Area Municipality except Dundas contains at least one designated industrial-business park, each of which has several hundred acres of vacant land, although servicing levels vary from almost completely serviced to only partially serviced with water and sanitary sewers.

The following Area Municipalities are evaluating possible further expansions of their planned urban areas:

Ancaster: In response to applications from several landowners for local Official Plan Amendments and corresponding Regional Official Plan Amendments, the Town of Ancaster is presently evaluating the need to expand the urban area boundary to include approximately 350 ha (864 acres) of additional land for development. At issue is the need to expand the urban area boundary when there is an 18-year supply of developable lands within Ancaster's current Urban Area. By approving the applications, Ancaster's Council would allow development on lands which are predominantly Class 1 agricultural lands and lands which are within the Niagara Escarpment Plan area. The urban expansion study recognizes that there is immediate need for expanding the urban boundary but presents a market-oriented argument for expansion. One landowner controls 70% to 80% of developable urban land. It is argued that price competition and housing choice will not occur if the market is dominated by one landowner.

Flamborough: The Town of Flamborough has recently endorsed for public circulation and comment, a Growth Strategy Study which is intended to evaluate the land requirements for residential and industrial growth to the year 2011. As part of this study, several "concept" plans are analysed involving various options available to Flamborough's Council. Included in the analysis are various ways in which the projected 5,600 dwelling units can be accommodated by 2011. The study looks at distributing the required dwelling units with the rural area, rural settlements, and the urban area. From the perspective of land use capability, the most likely concept would see at least 75 percent of the future dwelling units directed to new Urban Areas.

In addition to the land requirement for residential purposes, the Growth Strategy includes various concepts to meet the increasing demand for industrial land. In terms of potential industrial locations, the Study identifies four major areas. It is anticipated that the preferred concepts will form part of the Town's 5-Year Official Plan review in 1991-1992.

4 Transportation: Trends in Modes of Transportation

During Hamilton's rapid expansion between 1880 and 1920, electric streetcars were used as the primary means of transportation aside from walking. Then in the 1920s automobile ownership began to grow at a dramatic pace, but it was not until the post-World War Two period that automobiles began to replace mass-transit as the main means of commuting to work. Ridership on the Hamilton Street Railway, now essentially a bus service, has changed little since the 1960s, even though the population has steadily increased since that time. In 1961 HSR reported an annual total of almost 32,000,000 trips on its city and regional routes, a statistic that declined to approximately 27,400,000 in 1977 and roughly 25,500,000 in 1986, even though during the same period the Regional population steadily increased from 359,000 (1961) to 409,000 (1976) to 423,000 (1986).

Recent figures show steady declines in HSR ridership between 1986 and 1990. It is estimated that the comparable 1991 figure for total trips taken will only reach 22,500,000, a figure that will probably continue to decline further. (As of 1991, HSR has begun to include trips associated with the use of the "Over 70's" senior's pass in the total trips category, so that new total trip figures will appear substantially higher for 1991 and ensuing years even though real utilization of transit has declined). However, even with the steady decline in ridership and the Transportation Services Committee's commitment to review routes that pay less than 30 percent of their way (through ticket revenues), Hamilton's public transit system compares favourably with other urban areas of comparable size in Ontario. Of Ontario's medium-sized cities, only Ottawa has a public transit system that carries more customers each year, and in terms of provision of service Hamilton is second only to Ottawa, particularly in respect to night-time, early-morning and weekend service.

One major reason for this decline has been steady growth in automobile ownership. In 1920, there were 17.2 Hamilton residents for each automobile registered in the city, but by 1929 there were only 6.8 residents for each car, reflecting the tremendous boom in automobile use during the roaring twenties. Car ownership rates fluctuated somewhat during the dirty thirties, but by the late 1930s cars were making a comeback. By the late 1940s a new automobile-dominated culture had been established. By 1950 there were only 5 Hamilton residents for each registered automobile, 3.7 residents per car by 1960, and only 3.1 residents per auto by 1968. This trend towards greater levels of auto ownership still continues today. The Transportation Tomorrow survey revealed that the number of cars available to, or owned by, a household has increased from 1.1 in 1980 to 1.4 in 1986 in Hamilton-Wentworth.

As a result of the growing availability of automobile transportation and the expansion of low density suburban areas that promotes the use of the car and discourages the use of mass-transit, public transportation utilization rates have stagnated. Modal share (the split between various transport modes) during rush hours has changed little since the 1970s, even though gasoline prices have increased and congestion on roads has grown. The dependence on automobile transportation is particularly disturbing in the Region's outlying urban areas such as Ancaster, Dundas, Flamborough, and Stoney Creek. Reliance on the automobile as a means of travelling to work is now much greater in Ancaster, Stoney Creek, Flamborough and Glanbrook than it is in municipalities such as Mississauga and Markham, long noted for their marked dependence on the automobile.

Other reasons for the recent declines in public transportation utilization include: a decline in the employment levels found in many of the areas served by HSR; a major decrease in the size of the 15-24 year old cohort, a group which has historically been a major user of public transit; and changes in service levels, fares and parking cost and availability in the downtown area. It is interesting to note that although the most lightly-used bus routes are those that are located in low density outlying areas such as Dundas, Ancaster and Stoney Creek, that ridership levels are declining faster in the lower City than in the outlying areas. At the present time, however, the most heavily-utilized routes are located in lower Hamilton or along the major arteries of Hamilton above the escarpment (public transit users benefit from the simplicity of the grid system found on the mountain). In fact, just five routes (i.e. Barton, King, Delaware, Upper Wentworth/ Wellington, Upper James) carry over 50 percent of the H.S.R. ridership. It appears as though the population shift in the Region from older areas below the escarpment to the new, lower density outlying

areas is gradually shifting demand for public transit from the established parts of the Region to the new suburban parts. Unfortunately, the urban design associated with low density suburban-type developments found in the outlying areas is not always conducive to accomodating this need.

Industry, too, has seen a transition in transportation. Trucks have gradually surpassed rail and marine traffic as the primary form of industrial materiel transportation, particularly for light manufacturing and warehousing operations. As a result, industrial development now tends to take place in industrial parks located near or adjacent to major highways and arteries that facilitate easy trucking access, as opposed to pre-World War Two industrial development that occurred close to railroads, ports and abundant sources of labour. In addition to the freedom of movement associated with truck transport, another reason common cited for the the decline of industrial rail transport and the growth of trucking has been that railways must charge customers for the cost of maintaining railway lines, while trucking firms are heavily subsidized by government's maintenance of the highway system and pass on only part of the costs associated with the damage trucks do to the road network.

Most of the Hamilton-Wentworth's Industrial-Business Parks, which contain virtually all of the vacant land designated for industrial use in the Regional Official Plan, have little emphasis on rail or port transportation access, and are usually located close to planned or existing major highways and arteries. This phenomena is common throughout North America, where expansion in heavy industries that are dependent on marine and rail transport has been limited or non-existent, and expansion in distribution, warehousing and light-manufacturing dependent on truck transport has been rapid. The continued viability of the large steel-manufacturers in the Bayfront area has meant that Hamilton-Wentworth has avoided severe de-industrialization and decentralization that has affected so many other cities in the 1970s and 1980s. But new industrial and business-park development in the Region in the near future will take place in a decentralized, auto- and truck-dependent environment in the outlying suburban areas.

Although motorized vehicle transport appears to have changed little since the 1950s, with incremental improvements in gasoline combustion-engine car and truck technology and a growing reliance on road-dependent transportation during this period, all indications point to a potentially dramatic change in the early part of the 21st Century. Rail transportation may have been abandoned to a large extent in the post World War II era, leaving North American society extremely reliant on road-based, gasoline and diesel-powered transportation systems, but new technological innovations now offer the promise of numerous forms of alternative-fuel vehicles to supplement the standard 20th Century combustion-engine vehicle. In the area of mass-transit, diesel-powered buses are now being replaced with experimental natural gas, hydrogen, methanol, and propane-powered vehicles in numerous cities across North America and Western Europe, and in some urban areas of the world electrified buses or streetcars are making a comeback. Similarly, in addition to producing more and more efficient gasoline-powered cars, North American, Japanese and European auto manufacturers are beginning to bring alternative-fuel automobiles to the market on an experimental basis.

In Hamilton, the Hamilton Street Railway is utilizing 10 compressed natural gas-powered buses as part of a drive to diversify its energy supply sources and to reduce pollution emissions. HSR also is operating 198 conventional and 15 articulated diesel powered buses and 47 electric trolley buses, and is presently undertaking studies to determine which types of alternative fuel vehicles would be most appropriate for Hamilton-Wentworth in the 1990s and beyond. (HSR will take delivery of an additional 15 compressed natural gas buses in 1991). Although it is difficult to predict, "improved diesel" engines using particulate traps and cleaner fuel, natural gas and methanol engines appear to be the best bet for Hamilton-Wentworth's future alternative-fuel mass-transit needs because of the abundant availability of these energy sources, the low level of emissions associated with the use of these fuels, and the relatively low cost of these fuels.

Other potential fuels for public transit vehicles, such as hydrogen and electricity from batteries only have limited applicability in Hamilton-Wentworth in the near future because of the cost associated with purchasing, storing and distributing the fuel (or fuel cell in the case of batteries), and because the cost and difficulty associated with altering the bus fleet to accomodate the alternative-fuel engines. Innovation and improvement in the public transit field has been rapid in recent years in Japan, Germany, France and

California, and alternatives such as hydrogen, electrical batteries and methanol can be reasonably expected to be vastly improved as possible public-transportation fuel alternatives in the next two decades. While attempts to diversify energy sources and to move away from standard carbon-based fuels has been a major force behind these innovations, new environmental regulations stressing low emissions to improve urban air quality have become the most pressing reason for new alternative fuel technology development.

Air quality and gasoline consumption concerns have had a impact on automobile technology as well. Government legislation and energy taxes around the world are forcing automobile manufacturers to produce more efficient gasoline-powered cars as well as alternative fuel cars. American car producers already have to subsidize small car sales in order to bring up their average car mileage to standards imposed by the U.S. Government, and new proposed U.S. legislation would further increase the required average mileage standard and would force fleet owners to buy alternative fuel vehicles. In California, which comprises greater than a tenth of the total American car market, existing legislation will mandate that 2 percent of all cars sold will emit no exhaust at all, and this mandated share will rise to 10 percent in 2003. Massachusetts and New York are now following California's lead in the U.S., and several European countries including Germany are imposing new, much stricter emissions standards. Ontario has recently followed the international trend towards imposing stricter environment and energy-related automobile legislation by introducing higher "gas guzzler" taxes in the most recent budget.

New automobile technologies are being developed, but major constraints to cheap, environmentally-sound car transportation still exist. It is doubtful that gasoline cars can be greatly improved in terms of mileage and emissions without forcing the cost of automobiles to unreasonable levels or reducing the size of automobiles to ridiculously small proportions. Hydrogen power holds out the promise of an emissions-free car fuel, but hydrogen is still very costly to produce, is hard to distribute, and is difficult to store in a vehicle. Natural gas is cheap, easily available and produces lower levels of emissions, but requires frequent fillups and is suitable only for limited-distance commuting. Electrical cars appear to be a viable future alternative to gasoline-powered autos, but great improvements are still needed in battery technology before electric cars can compete in the market with standard types of vehicles. Methanol, too, may be a viable alternative, but at the present time the current distribution system is inadequate, the fuel is too expensive to produce on a large scale, and the fuel is a relatively bulky and volatile fuel to store and handle. To a large extent, future technological advances and small-scale community experiments will determine which types of alternative fuels are widely used throughout the industrialized world and thus Hamilton-Wentworth.

5 Transportation: Trends in Commuting Patterns

One major factor in the relative decline in the use of mass-transportation in North America in recent decades has been the increasing geographical complexity associated with employment-generated commuting trips. In the pre-World War Two environment, households usually contained one or two earners working nearby in industrial or basic service-related businesses. Work places were rarely distant destinations, if only for the reason that urban areas tended to be relatively compact. Families tended to follow the male worker to his area of employment, and if the wife worked to bring in supplemental income, her job almost inevitably was located near to her husband's.

Since the 1960s and the dramatic increase in female participation rates in the workforce and the growing independence and earning power of women in society, finding a balance between home and two places of employment has become more difficult. An added factor contributing to the increasing complexity of home-work transportation linkages has been the rapid growth of both suburban employment and suburban residency. As a result, the traditional late 19th Century, early 20th Century commuting patterns reflecting male-dominated employment in centralised industrial and CBD areas surrounded by residential enclaves, began to erode substantially in the 1960s. Commuting patterns are so diverse, and are of such a suburb-to-suburb and low-density nature, that providing adequate public transportation services to the majority of suburban residents is now extremely difficult and in many cases prohibitively expensive.

In most cities throughout North America, commuting between residential and industrial/CBD areas has given way to massive inter-regional, inter-suburban commuting patterns. In southern Ontario, inter-regional commuting has become quite commonplace in Metropolitan Toronto, Peel Region, Durham Region, and York Region. Up until recently, however, Hamilton-Wentworth has benefited from a relatively self-contained economy, with few residents needing to commute outside of Hamilton-Wentworth to find employment. However, recent statistics indicate that this may be changing as residents of Hamilton-Wentworth seek out jobs in the Greater Toronto Area and as workers from the GTA are lured to the Region by more reasonable housing costs. Between 1981 and 1986, the number of commuters travelling to the Halton Region from Hamilton-Wentworth increased 5,100 from 13,600 to 18,700, and the number of commuters travelling from Hamilton-Wentworth to Metropolitan Toronto increased 1,600 from 2,800 to 4,400.

Hamilton-Wentworth is now a net exporter of commuters (at least according to the last statistics in 1986). In 1981, 30,100 people commuted to work in Hamilton-Wentworth from other regions, while 23,100 Hamilton-Wentworth residents commuted elsewhere to find jobs. By 1986 the situation had changed sufficiently that 30,000 people commuted to Hamilton-Wentworth to find employment and that 31,900 residents of Hamilton-Wentworth commuted to jobs elsewhere. Although the number of people commuting to Hamilton-Wentworth to find jobs only changed marginally during this period, there was a marked increase in the number of Hamilton-Wentworth residents who opted for employment in other regions.

One result of the growth in automobile and truck dependence, and of the increase in inter-regional commuting, is a dramatic increase in traffic on the Region's roads since the 1970s, particularly since the population of Hamilton-Wentworth has increased only gradually during this time-period. The daily traffic count along Highway 2/53 between Ancaster and Brantford increased from 11,400 in 1976 to 25,950 in 1988, while the traffic count on the QEW at the meeting point of Stoney Creek and Grimsby (Niagara Region) soared from 37,600 in 1976 to 56,300. The QEW at the Hamilton-Burlington boundary saw an increase in the daily traffic count from 56,000 in 1976 to 75,000 in 1988, and the daily traffic count on Highway 403 where Dundas meets Burlington grew from 47,500 in 1976 to 68,300 in 1988.

Work Trips Within and Outside Regional Boundaries (1986)

REGION	Within Regional Boundary	% of Total Work Trips	Outside Regional Boundary	% of Total Work Trips	Total Work Trips
Hamilton-Wentworth	161,500	84%	31,900	16%	193,400
Halton	77,100	56%	61,800	44%	138,900
Peel	183,600	58%	133,200	42%	316,800
Metro Toronto	1,005,400	88%	138,000	12%	1,142,400
York	76,800	44%	97,200	56%	174,000
Durham	107,000	68%	49,500	32%	156,500
Niagara	146,000	92%	12,100	8%	159,000
Haldimand-Norfolk	32,800	80%	8,100	20%	40,900
Brant	38,500	85%	6,800	15%	45,300
Waterloo	150,800	94%	9,700	6%	160,500
Wellington	55,200	82%	11,900	18%	67,100
Oxford	29,600	85%	5,200	15%	34,800
Middlesex	149,300	98%	3,100	2%	152,400
TOTAL	2,214,500	80%	568,500	20%	2,783,000

Note: Numbers rounded to the nearest hundred

Source: Statistics Canada Census, POW Information

6 Transportation: Existing Plans for the Future

Comprehensive transportation planning in Hamilton-Wentworth has not been a priority in Regional departments for at least the past fifteen years. Perhaps the greatest reason for this was the perceived lack of transportation problems in the region, a perception that was and still is well-founded, at least from the perspective of road congestion difficulties. The slow but consistent growth of Hamilton-Wentworth's population, combined with an innovative network of one-way streets, have allowed urban development to expand geographically and accommodate more cars on the roads without any serious road transportation problems. The most substantial problem to date has been cross-escarpment movement and the lack of a direct, high-speed connection between the QEW and the 403 south of the escarpment. This specific problem, which the Redhill Creek Expressway was intended to solve, was apparent as early as the late 1950s and was first addressed in 1960s plans for an east-west-north-south expressway link.

Transportation planning is currently done on a site-specific and route-specific basis by the Regional Engineering Department and the Hamilton Street Railway Company. Land-use planning in rapidly-growing areas such as Stoney Creek and Ancaster includes only minor examinations of transportation planning issues, since the only transportation issues usually deemed of relevance are capacity projections for new roads produced by the Engineering Department (which is responsible for ensuring adequate road access to new subdivisions) and comments about public transportation access by HSR. HSR's administration also utilizes a computer model to project traffic flows and public transit use in various parts of the region, and this model is based primarily on land-use variables such as employment and population. This model is of some use in determining the ramifications of transportation policy decisions related to road construction or alteration, or proposed bus route revisions.

Although attempts are made to site high-density apartments along major road arteries, the Region and the Area Municipalities do not produce land-use plans that promote the use of public transit in any major way. To a large degree, Hamilton-Wentworth is similar to most other urban areas in North America in promoting an automobile-oriented urban design. The only difference between Hamilton-Wentworth and other urban areas in Canada and the United States has been the continued development of the City of Hamilton's major arterial roads in the grid format, a more reasonable format for efficient mass-transit than the curvilinear layout often found in newer suburbs.

It should be noted that one alternative form of transportation actively being investigated in Hamilton-Wentworth is bicycling. In late 1990, Regional Council approved a plan to have the Region accept jurisdiction for the long-term planning and provision of a region-wide bicycle route system, and the Region is currently in the process of undertaking a bicycle system study. Such a system appears to be promising for meeting future transportation needs, given that bicycling is such a healthy and non-polluting method of travelling. However, making Hamilton-Wentworth more accommodating to bicyclists will require a broad range of changes to existing road networks, and will probably entail the creation of a whole new system of bicycle paths.

There is now growing awareness throughout North America that mass-transportation access and other issues related to efficiency and the environment must be major considerations in urban physical planning. Unfortunately, a major drawback to the implementation of good-intentioned land-use plans has been the continued preference on the part of people for large houses with two garages in low-density settings. The use of public transportation is strongly correlated with the relative convenience of using public transportation, and convenience depends heavily on frequency of service and availability of facilities. The adequacy of transportation facilities and frequency of service, in turn, depends almost completely on the density of the residential areas being served and the employment areas that are major destinations.

Subways, light rail, and heavy rail mass-transit are the most efficient and most appreciated forms (suburbanites especially prefer rail transit to bus transit) of public transportation in urban areas, but are feasible only under density conditions usually obtained in very large cities containing over a half million people because of the tremendous capital costs involved. Streetcars and buses are appropriate for both large and small cities, and land-use densities ranging from dense heavily populated urban areas to lightly populated suburban areas. However, as density declines so too does population and ridership levels, resulting in diminished levels of frequency of service and convenience. Eventually, once population densities decline to a certain point, as in suburban areas of Hamilton-Wentworth such as Ancaster and Flamborough, the level of convenience and diversity of destinations is so limited as to virtually eliminate the prospects for reasonable ridership levels on bus routes. Thus, the density of new subdivisions approved by municipal planning authorities in large part determines the level of ridership for decades to come.

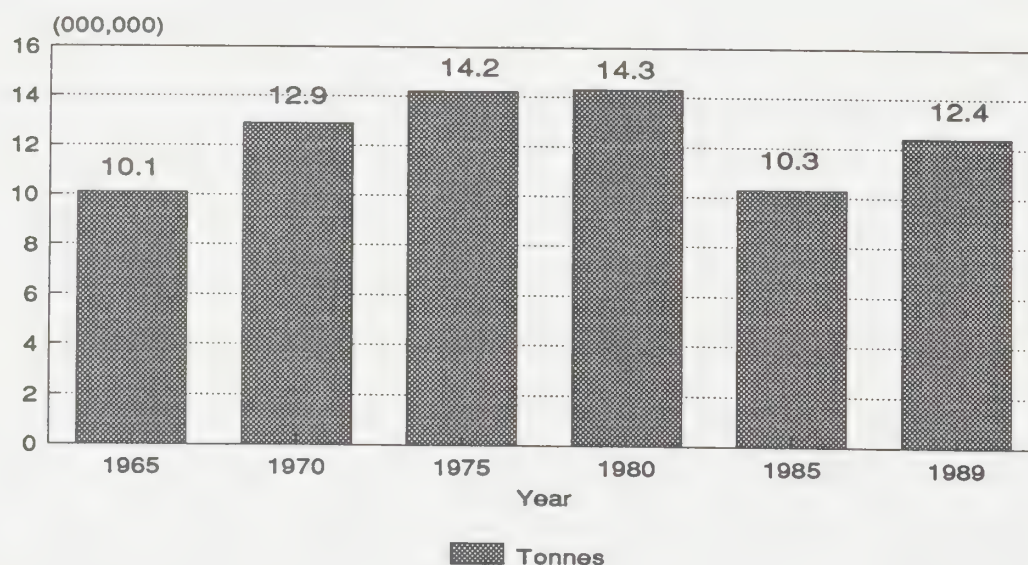
Any future attempts to improve mass-transportation utilisation will require increased densities and road networks realigned so that streetcars and buses could swiftly and efficiently move people to the broad diversity of employment destinations that already exist. It is unclear, however, to what extent the overall land-use pattern can be altered, since so many automobile-dependent residential and industrial subdivisions have been built since the end of the Second World War. These homes and industrial buildings, built on the assumption that cheap gasoline-powered vehicles would always be available to the majority of homeowners and employees, may be the single most important obstacle to energy efficiency in the 21st Century. It is also unclear as to how much effect future dramatic changes in transportation technology, land-use densities, or fuel prices would actually have on modal choice, since the public has shown a remarkable continued attachment to automobile transportation in the face of growing road congestion, rising gasoline prices, and increased auto insurance costs in past years.

7 Hamilton Harbour

Hamilton Harbour remains one of the most active in Great Lakes area. Total shipments have remained relatively strong throughout the 1970s and 1980s for a Great Lakes port, and shipment to and from overseas ports has increased significantly since the early 1980s, reflecting a recovery of economic activity after the 81-82 recession. In general, total tonnage has fluctuated between 8.5 and 14.5 million tonnes a year between 1965 and 1989, with the majority of the shipments (89 percent) in and out of the harbour comprised of iron ore, coal, iron, steel and metal products. Of the iron ore, metal products, and coal shipped or recieved in the Harbour, almost all was destined to, or shipped out from Dofasco and Stelco.

Of the remaining roughly 11 percent of the shipments received or embarked at the harbour, most consisted of petroleum products and other hydrocarbons, construction materials, and agricultural products such as grain. As a result of the domination of port activity by iron ore, coke, coal and various metal alloys deliveries and iron, steel and metal product shipments, activity in the harbour is largely dependent on the market share and continued financial viability of the large steel operations in Hamilton. It should therefore be noted that the transportation facilities in Hamilton Harbour can be viewed largely as a appendage to the huge physical plant operations of the two largest industrial firms in the region: Stelco and Dofasco.

Tonnage In and Out of Hamilton Harbour



Source: Hamilton Harbour Commissioners

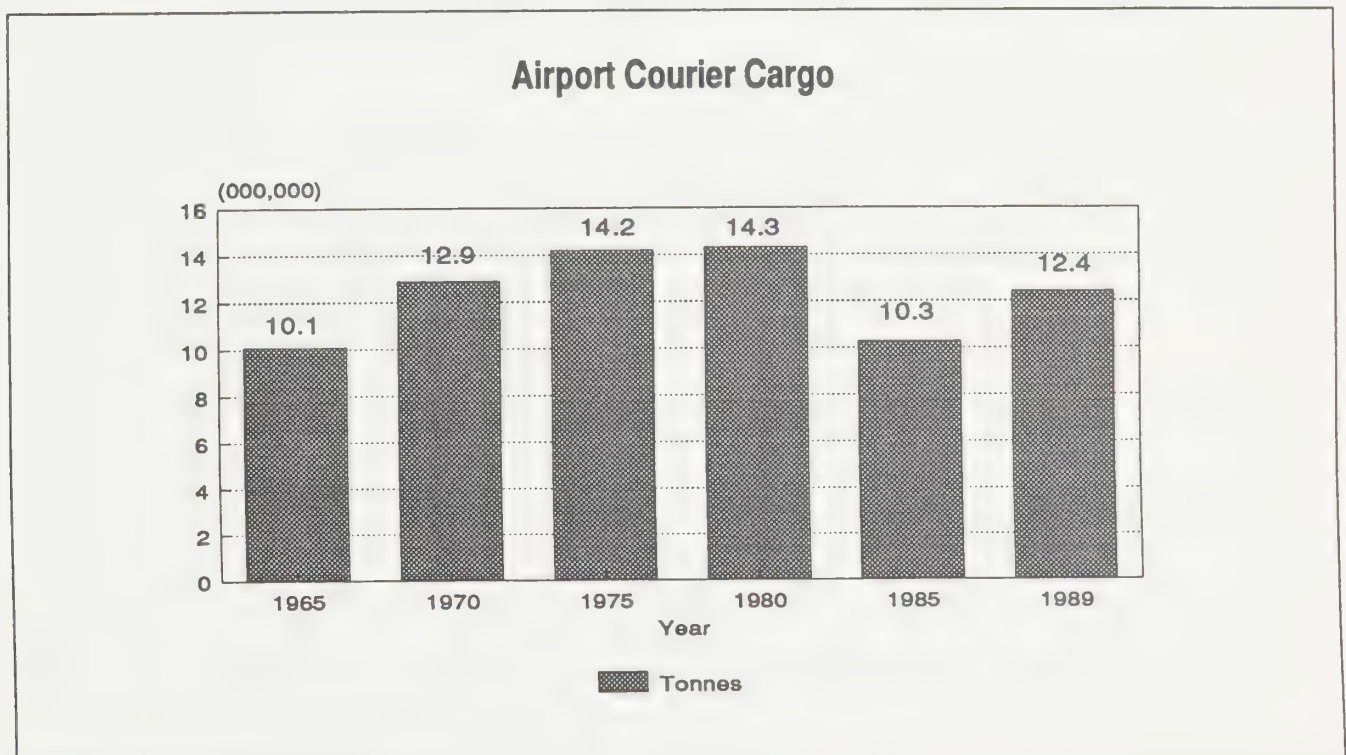
8 Hamilton Airport

Hamilton Airport is still a small regional airport by North American air cargo and passenger volume standards. Virtually all of the airport's traffic is related to the courier business, short-distance passenger flights to cities like Montreal and Ottawa, charter-flights, and privately-owned airplane take-offs and landings. To a large extent, increasing traffic at the airport will depend on the growth of the courier business moving through Hamilton, and on the expansion of the facilities to accomodate larger-scale operations and long-distance flights.

A study on the airport completed in 1989 by Aerocan Aviation Specialists produced three major findings related to capacity for growth in the air cargo market:

1. The ability to operate into and out of Hamilton Airport 24 hours a day with few delays provides Hamilton Airport with a positive advantage over other airports.
2. The distinct lack of any modern air cargo facility is the most obvious deficiency that discourages greater use of Hamilton Airport for air cargo and air courier activity.
3. The length of the longest runway at 8000 ft effectively restricts Hamilton Airport to the domestic and transborder sectors of the market. The international sector, which requires a longer runway for non-stop long haul service cannot be served properly by the current runway length.

However, even with the present limitations caused by the airport's current facilities, airport traffic as the result of courier transportation of packages and letters has increased since the mid 1980s. With a larger runway and more facilities, the airport could become a major outlet for the Greater Toronto Area passenger market, which until the present time has largely been funnelled through the overcongested Pearson Airport in Mississauga.



Source: United Parcel Service & Federal Express

9 Trends in the Expansion of Municipal Trunk Services in Hamilton-Wentworth

Regional services, which consist primarily of water and sanitary sewer treatment, distribution and collection, have been extended to include virtually all developed urban areas. Since the 1970s rapid progress has been made in servicing urban areas in Ancaster, Flamborough, Glanbrook, upper Hamilton, and Stoney Creek. Earlier infrastructure provision plans (1970s) have largely been accomplished, but numerous projects are being currently undertaken by the Regional Engineering Department as the result of petitions for local improvement projects. In 1989, for instance, the Region tendered construction contracts for some 23.8 kilometers of sanitary sewers and 27.7 kilometers of watermain, revealing a fairly high level of activity in the expansion of urban services.

Most of Ancaster's urban area is hooked up to the Regional water and sanitary sewer system. Waterdown in Flamborough is now serviced with water from the Regional Water Treatment Plant in Dundas, and construction is underway to connect Waterdown and Clappison's Corners to the Regional sanitary sewer system as well as to rechannel Borer's Creek to improve storm drainage in the area. In Glanbrook, the Mount Hope area has been fully serviced with water and sanitary sewer as far as Airport Road, so that the only urban settlement not serviced in that Township is Binbrook, which is remote from existing services.

Stoney Creek's urban development generally occurred in a west to east fashion, with most urban areas being serviced. Virtually all of urban Hamilton and Dundas have been serviced with water and sanitary sewers. In the Dundas-Hamilton-Stoney Creek urban belt the most pressing environmental planning problem has probably been storm water drainage. Storm drainage still presents a problem in Stoney Creek in some newly developing areas on the southern side of the QEW highway, and in areas in Hamilton above the escarpment. It should be noted that storm water drainage is the responsibility of the Area Municipalities (and in a regulatory context the Conservation Authorities).

Servicing has not always conformed to the Regional and Area Municipality Official Plans. Local planners and the Regional Planning Department have expressed concerns about the Regional Engineering Department extending services into rural areas without valid justification. Section 10.1 of the Regional Official Plan sets out relatively specific criteria for those exceptional instances when water and sewer services are to be provided in rural areas. Unfortunately, these criteria are somewhat ambiguous, and the process by which decisions are made about rural servicing appears to be less than perfect.

According to section 10.1 of the Regional Official Plan:

It shall be the policy of Regional Council:

- 10.1.1 To provide an adequate supply of potable water and a suitable sewage collection and disposal system to the designated Urban Policy Areas as the land is developed.
- 10.1.2 To provide for the improvement of water supply systems, in existing urban areas with substandard water pressure and storage capabilities where financially feasible.
- 10.1.3 To either seek the correction of individual sewage disposal systems or to supply municipal sewers of limited size and/or municipal water where feasible to areas other than that stated in Policy 10.1.1 where:
 - (a) potential health hazards exist and/or
 - (b) environmental degradation is occurring and/or
 - (c) inadequate supplies are causing undue hardship on the residents.

As 10.1.3. points out, the Region is to extend water and/or sanitary sewers out to rural areas only when a well-documented need exists. The reasoning is that when services are extended into rural areas, rural Property-owners begin to expect that they should receive services as of right, which creates the expectation that the area will soon be designated urban. By refusing to service rural areas, the Region can realize two major advantages. Firstly, the expectation of urban development outside of planned urban areas is reduced, thereby diminishing pressures on area municipalities and the Region to redesignate agricultural and natural areas for residential and industrial uses. Secondly, Regional funds used to expand municipal services into rural areas could be used to retrofit or add to existing infrastructure in designated urban areas.

10 Carrying Capacity of Hamilton-Wentworth: Water, Sanitary Sewers and Private Septic Systems

Since the early 1970s, no major study has been undertaken of the Region's capacity to provide water and sanitary sewers to various projected levels of populations. One reason for this lack of long-range projections is that growth has been steady and manageable over the past three decades. The Region has made several improvements to its processing facilities for treating water and sewage during the 1970s and 1980s, but has done so as part of specific programs rather than as part of a larger carrying-capacity scheme.

An important aspect of past "carrying capacity" or facility planning projections that should be noted is the tendency to use current service utilisation figures as a base to estimate future service demands. An extension of this philosophy is the "flush and gush" form of planning that effectively ties population capacity planning to infrastructure capacities rather than vice-versa. The problem with these approaches is that they assume that the means of accommodating population or urban growth will be through increasing the supply of the service rather than diminishing the demand for the service, and that new developments will be built without any other justification than that more servicing capacity was available. As will be discussed, certain types of municipal facilities can be utilised in a more economic manner so as to accommodate more growth without spending vast sums of Regional money to improve the facilities in question.

10.1 Municipal Sewage:

Perhaps the greatest municipal-services constraint on future growth, as revealed by recent historical trends, is the treating and disposal of sewage collected in the Region's sanitary sewers. Although quite capable of dealing with Hamilton-Wentworth's normal sewer level flows, the Region's sewage treatment facilities are sometimes overwhelmed during periods of heavy rain, releasing raw sewage into Hamilton Harbour, because of the existence of combined sanitary and storm sewers in the City of Hamilton. At the present time, the Region's sewage treatment facilities consist of three sewage treatment plants: the Woodward Avenue STP, Dundas STP and the Waterdown STP.

The smallest plant, the Waterdown STP, has a design capacity of 2,730 cubic metres a day and is already operating at a average level of 2,700 cubic metres a day. The second largest plant, the Dundas STP, had a daily average flow of 10,647 cubic metres in 1989, services part of Waterdown and part of Dundas, and will soon be connected to the much larger Woodward Avenue STP indirectly through the Regional sanitary sewer system. This relatively small treatment plant releases its treated effluent into Cootes Paradise, and is unable to deal with substantially increased levels of sewage because of the limited assimilative capacity of Cootes Paradise (the design capacity of the STP is 18,180 cubic metres/day). The Woodward Avenue STP in Hamilton had a daily average flow of some 311,000 cubic metres in 1989, services most of Hamilton, Stoney Creek, Ancaster and part of Dundas and Glanbrook, and discharges its effluent into Hamilton Harbour. Due to existing constraints, any increase in the regional production of sewage will have to be dealt with at the Woodward STP, so that the capabilities and limitations of the Woodward STP largely reflect those of the Region in the area of sewage disposal.

Specifications for the Woodward STP indicate that the plant is capable of providing secondary treatment for 490,000 cubic metres/day (90 million gallons/ day) of mixed domestic, commercial and industrial sewage, and peak secondary treatment of 614,000 cubic meters/day (135 million gallons/ day) from the Region's combined sewer system. Given that the average flow in 1989 was 311,00 cubic meters/day and 335,000 cubic metres/day in 1990, there appears to be sufficient secondary capacity at the plant to accomodate substantial increases in sewer use that might result from residential and/or industrial growth. It should be noted, however, that the primary treatment section of the plant is already working beyond its design capacity (273,000 cubic metres/day), resulting in a situation in which the underutilized secondary treatment facilities have to compensate for the inadequate primary treatment. An expansion of the primary treatment section of the STP is therefore required before the STP can accomodate substantially higher levels of sewage.

Unfortunately, sudden bursts of water flow to the Woodward STP that result from unusually heavy rains. Although the STP can normally accomodate flows above that normally experienced during dry periods, sudden storms can fill the combined sanitary/storm sewers found in the older sections of the City of Hamilton, and force the Woodward Plant to bypass sewage directly into Hamilton Harbour. The resulting bypassed sewage can dump substantial quantities of highly polluted wastewater into the harbour. In addition to the obvious problem of mixing standard sanitary sewer water with storm water, the storm water itself during these storm periods is extremely polluted, having collected large quantities of contaminants, bacteria and sediments from the Region's roads and development sites. As a result, it would not be unreasonable to assume that the Region would be under pressure from the Ministry of the Environment and environmental groups to correct the overflow problem before any significant expansion of the sanitary sewer collection and treatment system would be tolerated.

In the final analysis it is the carrying capacities of Hamilton Harbour and Lake Ontario that pose the true constraints on any increase in the utilization of the Region's sanitary sewer system. The Hamilton Harbour Remedial Action Plan process has revealed that the Harbour is still under a great deal of stress from man-made pollution. To a large extent the Region's ability to cope with increased numbers of residential and /or industrial connections to the sewer system will depend on the success or failure of Regional programs to reduce the quantity and improve the quality of waste water disposed of through the system. Much of the improvement in the pollution levels monitored in the harbour observed since the 1970s have been the result of diminished pollution discharges from industrial enterprises, specifically from Dofasco and Stelco; however, Regional STP discharges have been improved as well, particularly in the area of phosphorus loadings.

Future increases in the capacity of the sanitary sewer system to accomodate new users depends on Regional actions and policies such as more stringent sewer-use bylaw enforcement, implementation of MISA (provincial municipal and industrial strategy for abatement) standards for industrial users, charging realistic rates for municipal water (which will encourage water recycling and conservation), and improving the Woodward facility to remove more contaminants before the effluent is discharged. It is doubtful that the Region could allow substantial growth in residential development by assuming that the harbour can accept even more nutrients and contaminants without severe damage to the harbour ecosystem.

10.2 Rural Septic Systems:

Limitations on the ability of Regional residents to dispose of more wastewater through septic systems depends less on infrastructure and equipment capabilities than on the environment's ability to absorb and deal with waste. Just as a marked increase in sewer utilisation would almost inevitably lead to a decline in the quality of water in the harbour, increased use of septic systems in rural areas would lead to a decline in the quality of groundwater in affected areas.

When the Regional Official Plan was created, the Region acknowledged some responsibility to ensure that privately-owned septic systems would not pollute nearby surface waters or groundwater supplies. To this end, part of the Official Plan addresses the capabilities of various types of soil and geological attributes to deal with septic system byproducts, and specifies minimum allowable lot sizes for rural residential developments that rely on septic systems. In general, "where soils have a "T" time (percolation rate) between 1 and 50 minutes per centimetre, a minimum lot size of .2 hectares (approximately 1/2 acre) is required. Where soils have a "T" time (percolation rate) less than one minute or greater than 50 minutes per centimetre, a minimum lot size of .405 hectares (approximately 1 acre) is required. The Regional Health Department, too, must give its consent before new private septic systems are put into place.

Many North American municipalities have been forced to make their minimum lot size regulations even more stringent in recent years because of mounting evidence that groundwater supplies are being threatened by overdevelopment and overuse of septic systems in rural areas. Specifically, septic systems can lead to both bacterial and chemical contamination of nearby aquifers and groundwater wells, particularly if local subsurface materials are very permeable and allow the rapid vertical and/or horizontal movement of contaminants. The most common types of contamination for groundwater sources from nearby septic systems are: 1) excessive nitrate content; 2) excessive ammonia; and 3) high levels of bacteria, often as indicated by fecal coliform levels. Hamilton-Wentworth will probably be following the lead of the Region of Waterloo in re-evaluating its groundwater and septic system policies because of increasing concerns over groundwater pollution, and more restrictive regulations concerning minimum lot size and septic system maintenance may be implemented in the near future.

10.3 Municipal Water:

Urban development is often constrained by a limited municipal capacity to supply water to proposed residential subdivisions. In the Greater Toronto Area, the Durham and York Regions have been forced to slow down their urban expansion because the expansion of the municipal water network has lagged behind the demand for new housing in greenfield areas. Since water must be obtained from Lake Ontario and then transported northwards to the newer urban settlements in Durham and York, bottlenecks develop when municipal water treatment facilities near the source (in this case it is often Metropolitan Toronto water treatment plants) and trunk lines are found to be working at full capacity. In the Region of Waterloo, new urban development was reduced because such a large portion of that region's municipal supplies are taken from limited groundwater resources.

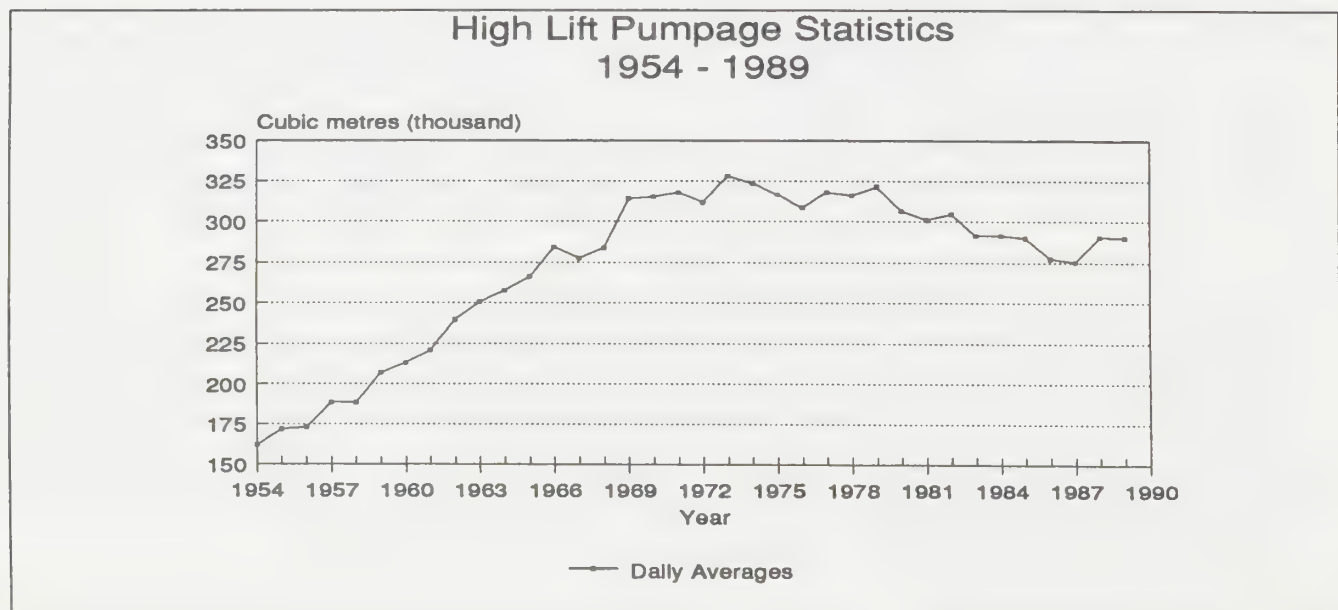
Hamilton-Wentworth, on the other hand, has never experienced any substantial limitations on urban development caused by a shortage of raw water. Up until the present time, the only limitations on urban growth related to municipal water provision have been caused by the size of the water distribution network. In recent years there have been no major problems with water provision to new subdivisions, or to existing areas that are being retrofitted with direct connections to the Region's water supply, even though substantial geographical expansions to the regional water network have taken place. The only significant settlements not serviced by Regional water from Lake Ontario are found in Flamborough and Glanbrook.

The Region's water treatment and pumping facilities are concentrated at the Woodward site in Hamilton, near the location of Hamilton's original 19th Century municipal water pumps. The facilities include intake pipes reaching into Lake Ontario, a series of lowlift pumps which bring in water from the lake, a water treatment center, and a series of high-lift pumps which in conjunction with other pump stations located throughout the Region ensure that water is provided to all serviced households and businesses. Raw water is obtained in Lake Ontario through three pipes, which are 1.22, 1.52 and 2.44 meters in diameter, and which reach 640 meters, 915 meters, and 945 meters, respectively, into the lake. Six vertically driven pumps, four of 227,272 cubic meters/day and two of 163,636 cubic metres/day capacity deliver water to the Water Treatment Plant located approximately 550 meters away from the lake.

Raw water is sent through a preliminary treatment process including chlorination to kill bacteria, the injection of liquid alum to reduce turbidity if needed, and flocculation using a mechanical mixer. The water is then subjected to a full treatment process, which includes further chlorination, clarification, filtration, and ammoniation (to ensure that the chlorine residual is maintained in the water). The water is also fluoridated to ensure that the fluoride concentration is approximately 1 part per million. Once the water has been treated, it is sent via the high lift pumping station to a series of reservoirs and local pumping stations throughout Hamilton-Wentworth. The high lift pumping station consists of six pumps which can transport a total of 372,600 cubic metres/day at full capacity.

At the present time the water treatment plant is working well below capacity. Water demand grew at a rapid pace during the 1950s and 1960s, but peaked in the 1970s and declined somewhat in the intervening period. This slight reduction in demand in the 1980s can be attributed to a number of factors including increased recycling of water by industrial users to reduce polluted water emissions and the metering of households throughout the Region since the mid-1970s. Between 1983 and 1989, the Region's high lift pump statistics varied from annual averages of between 275,000 cubic metres/day and 292,000 cubic metres/day, down considerably from annual averages of between 312,000 cubic metres/day and 328,000 cubic metres/day.

It is now generally accepted that municipal water demand is extremely sensitive to pricing policies, and that a municipality's water treatment plant's capacity need not be expanded in the face of rapid urban expansion if metering of individual homes and businesses is implemented. Evidence from other cities in Ontario suggests that the quantity of water pumped from municipal water treatment plants can be reduced as much as a third simply by implementing user-pay systems that charge households and industries for the amount of water they use. Since the most price-elastic use of municipal water appears to be garden watering in summer months (people are less apt to water outside if charged to do so), peak summer demand levels are greatly reduced with the introduction of metered-water, thereby putting less demand on municipal water infrastructure capacities. In Hamilton-Wentworth most residential structures are metered, and building owners must pay a straight charge for each cubic meter of water used, thus encouraging a conservative approach to water use. Unfortunately, the Region effectively undercharges industries, since the industrial and commercial rate structure is such that the greater amount used, the less the per-unit cost.



Source: Hamilton-Wentworth, Department of Engineering Annual Report, 1989

Given only partial implementation of realistic water-cost policies and the added capacity within the current water treatment plant, there is ample room for expansion of services to new subdivisions. Growing public awareness about the need to reduce residential emissions of wastewater into the sewer system may result in a substantial reduction of water demand as well as production of domestic wastewater. Innovations such as low-flow shower heads and smaller toilet tanks will not only reduce sanitary sewer flows but also overall water demand. Realistic water pricing and increased concerns over sewer discharges that lead to water recycling will reduce industry's demand for water. It should also be noted that total water demand in the Region has not increased since the 1970s, even though the population has continued to increase and the geographical extent of serviced urban areas has grown substantially.

10.4 Groundwater Provision:

Although over 75 percent of the population is serviced with Regional water from the Woodworth Water Treatment Plant, groundwater continues to be a major source of potable water for residents of many outlying areas of Hamilton-Wentworth. The urban areas of Ancaster and Waterdown, which were served by community groundwater wells at the time of the creation of the Region, have now been connected to Regional services. However, the Region still operates community pumps in Freelon, Carlisle, Greensville and Lynden, and many residential, agricultural, and rural industrial structures are supplied by privately-owned and managed groundwater wells.

Groundwater supplies are extremely vulnerable to contamination, either from biological or chemical sources. The Region is already examining its policies regarding new rural residences that are served only by privately-owned groundwater wells. In addition to being vulnerable to contamination from industrial sources, buried and long-forgotten chemical-storage containers, old landfill sites, and leaking underground fuel storage tanks, rural groundwater wells are threatened by bacteria from neighbors' septic systems and runoff from nearby farm operations. Growing contamination problems in Flamborough have indicated that Hamilton-Wentworth will inevitably face the same types of problems of large-scale groundwater contamination problems that have already been experienced in the Region of Waterloo and numerous American areas. Groundwater wells are not a dependable source of potable water for future large-scale residential development (as in rural subdivisions). The Region is currently attempting to obtain Provincial funding for a program to systematically test all private groundwater wells in an attempt to identify how widespread groundwater contamination is at the present time.

11 Conclusions and Implications for the Future:

If urban expansion continues at the same rate and density levels as the past hundred years, the possibility exists that the entire Region could be eventually be totally urbanized. North Americans are now coming to grips with the reality that many resources are extremely limited in availability and can become quite scarce if special measures aren't taken. Since southern Ontario is now approaching population densities found in places such as Western Europe and the Orient, it may be wise to adopt some of the approaches Europeans and Asians have successfully employed in the management of their much older urban areas.

In countries such as Germany, France and Holland, where growing populations and pressures for expanded urban development have clashed with the need to preserve limited farmland and natural areas for centuries, there is a significant awareness of the effects urban sprawl can have on the nearby environment. Post-war policies in many European countries have severely restricted urban development by promoting relatively high-densities (but not necessarily high-rises) and agricultural and forest-preservation programs. Land-use controls in France and England, for instance, have halted the expansion of the Paris and London metropolises to a large extent, and have funnelled growth into "infill" areas of these immense cities. Germany, the world's preeminent example of industrial and technological success, has managed to contain urban development in relatively small urban areas without impairing its economy's ability to expand at a rapid pace. These controls have not been implemented without costs; however, the West Germans, like many other Europeans, have long ago realized that the destruction of their remaining farmland and forests through urban sprawl would unreasonably threaten their environment and their own future well-being.

Hamilton-Wentworth, as the southern fringe of the Greater Toronto Area, and as the pivot of the Golden Horseshoe, will continue to be the focal point of extremely strong urban development pressures. Hamilton-Wentworth and indeed the entire Golden Horseshoe now face the same dilemma that Western Europe has faced for decades if not centuries: any expansion of urban land-uses to accomodate residential, commercial or industrial development will result in the destruction of valuable headwater areas, woodlots, drainage basins, vineyards, fruit farms, wildlife preserves and various types of agricultural lands. Since most Canadians are concentrated in a thin band of land running along the American border, more emphasis should be placed on evaluating the long-term effects of continuing with current land development philosophies.

The major limitations on population growth and urban expansion in Hamilton-Wentworth are related more to the ability of the surrounding environment to absorb society's wastes and byproducts than to limitations on Regional Government's ability to provide expanded urban services and infrastructure. Unlike many of the Greater Toronto Area municipalities, which have had to limit growth because of restrictions on their ability to provide new subdivisions with water and sewer trunk lines, Hamilton-Wentworth seems well-positioned to accomodate any new urban growth that may be undertaken. However, the local environment does impose certain limitations on any future population growth prospects. The harbour is already under severe stress from the discharges into it from the municipal sewage treatment plant and direct industrial dischargers. An increase in the quantity or a reduction in quality of the STP discharges resulting from increased sewer use would not be favorably looked upon either by the Ministry of the Environment or the general public. As a result, it appears that the environment will be the major constraining factor in major future development plans.

The Region has been fortunate in being capable of expanding services such as water and sewer to meet the needs of virtually all expanding urban areas, but this growth of services has not always been tied to well-reasoned, Region-wide comprehensive planning. More emphasis must be placed on coordinating land-use planning and urban services provision if the Regional Official Plan is to fulfill its original mandate. Land-use controls should be used in conjunction with, and not be at odds with, water and sewer provision policies. Servicing policies used by the Regional Engineering Department have a tremendous impact on determining where and when new urban growth will take place, particularly near the borders of designated urban areas. Any successful attempt to prevent the development of existing rural areas as semi-urban areas (rural estates, etc.) will have to include closer cooperation between the various involved departments.

Hamilton-Wentworth residents still tend to be employed in the Region rather than elsewhere, but this situation appears to be gradually changing. Lower housing costs increasingly attract people who are employed in Halton Region, Peel Region, and Metropolitan Toronto, and the growing Greater Toronto Area economy is attracting Hamilton-Wentworth residents who can often find higher-paying jobs in Oakville, Mississauga, and the City of Toronto. If southern Ontario and the GTA continue to expand at a rapid pace after the current recession, Greater Hamilton will feel increased pressure to integrate into the growing Southern Ontario megalopolis. It may not be unreasonable to assume that Hamilton may soon be one of many service centers located in one interconnected metropolitan area stretching from Niagara in the south-east to Kitchener-Waterloo in the south-west to Barrie in the north-west to Oshawa in the north-east. This is not only plausible but probable if cheap automobile transportation remains available to commuters or if efficient and reasonably-priced GO railway services are provided throughout these areas.

This type of interconnection of transportation and economic links will present new opportunities for the Region. Although Greater Hamilton residents tend to look on Toronto's growth with a hint of suspicion and perhaps a little wariness, the growth of the GTA may benefit Hamilton-Wentworth's residents more than may be generally perceived. Although Toronto managed to absorb a large part of Hamilton's commercial enterprises in the field of banking, insurance, and finance in the late 19th Century that retarded Hamilton's commercial and office-sector growth in the intervening period, over-congestion and high prices in Toronto may eventually turn the tide in the other direction. Satellite office nodes of immense size have arisen in North York, Mississauga, and Scarborough as the result of decentralization pressures in the 1970s and 1980s. If the GTA continues to expand in terms of employment and population, Hamilton is well-positioned to accommodate much of the development that would occur as more companies and professionals flee the high land costs and congestion of Toronto and seek a nearby location. Hamiltonians may stop thinking of their city as a competitor to Toronto and begin to think of it as the oldest and strongest of the GTA satellite cities. Once efficient rail transportation (GO) is established with downtown Toronto the already excellent Hamilton CBD-Toronto CBD transportation links will be further improved.

For the past five decades, mass-transit use has declined in relative terms to the automobile, which appears to be still growing in popularity as a means of transportation. Numerous factors appear to have led to this marked dependence on the automobile. Firstly, workers are travelling to a more diverse geographical pattern of employment sites, and these work destinations are increasingly located in low-density environments where public transit is a difficult if not impossible option. Many residents have found jobs in suburban industrial parks such as the Stoney Creek IBP or Hamilton Mountain IBP, or in other Regions like Halton, and have been effectively required to drive to work. This dispersal of employment locations has reduced the number of people who participate in ride-sharing since the 1970s, presumably because it is harder to arrange commuting routes that are similar to those of neighbors.

Secondly, new subdivisions, usually being less dense, discourage public transit usage by making walking distances from residences to pick-up points too far. Commuters refuse to walk more than certain distances to get to public transit and shopping facilities if a viable alternative exists. To compound this problem, buses do not have express lanes and must wait in traffic, and bus shelters are often inadequate or non-existent in suburban areas, making waiting for a bus in bad weather even more undesirable.

Thirdly, many people perceive automobile ownership and use as an indicator of prestige, or else simply like driving. Many men believe that taking public transit is beneath their status (women traditionally use public transit more), and many people perceive cars to be a safer or more pleasant experience than buses. All of these attitudes are reinforced by advertisements, movies and television programs, which emphasize the "independence" and "success" supposedly attributable to automobile users. Unfortunately, Bombardier and other producers of mass-transit vehicles do not spend hundreds of millions of dollars promoting the

The Hamilton Street Railway has managed to maintain excellent service considering the constraints it faces, and Hamilton still has a good public transit system in comparison to most comparable-sized Canadian and American cities. Hamilton also benefits from two factors that may facilitate an increased provision of mass-transit services in the 21st Century: Lower Hamilton is still quite dense in terms of population and employment, thereby promoting the use of buses and potentially streetcars; and Upper Hamilton has been largely developed using a grid-road pattern that is an efficient way to deliver mass-transit services. These two factors could play an important role in moving the Region towards a more energy-efficient form of transportation in the 21st Century than the current automobile-dominated system.

Newer residential subdivisions in Ancaster and Stoney Creek are extremely vulnerable to major changes in modal preferences caused by energy shortages, environmental crises, or improvements in mass-transit technology. It would seem that, given the very high dependence of Dundas, Stoney Creek, Ancaster, and Flamborough residents on automobile commuting, that the gradual world-wide reduction in availability of petrochemicals and mounting concerns over combustion-engine emissions will almost inevitably result in some major readjustment of the current land use-transportation pattern in Hamilton-Wentworth. The changes could come in either of two forms:

One possibility is that new technologies will allow suburbanites to continue commuting vast distances in single-passenger vehicles. These types of potential new technologies include the electric car, the hydrogen-powered car, the natural gas-powered car, and alcohol-powered car. These new types of single or two-passenger vehicles would presumably make use of fuels that are more available to society than oil-based derivatives and produce less vehicle emissions than current forms of automobiles.

Another possibility is that the cost of virtually all energy forms will increase dramatically, and/or that vehicle emissions of almost all types would be prohibited. If this were to happen, low-density subdivisions would lose their appeal, particularly to working men and women, and many of these areas would eventually have to be redeveloped or abandoned. In the European and Japanese situations, high gasoline prices (two to four times the price paid in Canada) imposed by governments have led to a reliance on mass-transportation as the primary method of commuting to places of employment, while automobiles have been largely relegated to use during leisure time.

Present forms of low-density suburban development are not conducive to high levels of public transportation services, and promote the automobile and truck as the primary form of transportation. Current urban design standards used in suburban areas, which have changed little since the 1950s, emphasize the use of vast amounts of empty "greenspace", usually little more than mown grass and shrubbery, and discourage pedestrians from taking any more than short, leisure-oriented strolls. Residential and industrial areas are divided from one another and commercial nodes by miles of road and/or freeway, making pedestrian access to essential services and shopping facilities very difficult, thereby ensuring a continued reliance on automobiles. Winding roads, cul-de-sacs and unstructured layouts deter efficient public transit, and the scale of development is such that the North American attitude towards walking, bicycling or using public transportation to get to work are only reinforced (In most North American cities, no self-respecting manager or professional will take public transit, while in the older Eastern Seaboard and European cities, walking and public transit are common forms of transportation for all classes of society). Many business and industrial parks are not even provided with sidewalks, since attempting to walk to any nearby destination would probably be a futile venture.

Residents of Hamilton-Wentworth have become accustomed to a continuous growth in both the size of houses and the number of cars available to the average household. It is unclear as to how long the expansion in car ownership and home sizes can be sustained, and society may wish to eventually abandon the proposition that "more is always better", at least as far as home and car ownership is concerned. In recent years the environment has become a major concern of the media and the public, at least on a superficial basis, but it is still debatable whether the general public is willing to accept a substantial reduction in their standard of living in terms of material goods to alleviate stresses placed on the ecosystems around them. Even if people remain unconcerned about the effect of continued economic expansion on the environment, it is also possible that people's demand for larger houses and more cars will soon be satiated, and that increased consumer expenditures will be funnelled into tourism, expenditures on communications and computer equipment, and leisure activities in general.

Reliance on the automobile as the primary source of transportation has a number of drawbacks from a social perspective. Foremost of these is that certain segments of society will always be unable to drive, and thus are disenfranchised in a community that is built around the car culture. Severely disabled people, children, seniors no longer able to drive, people unable to obtain driver's licenses, and people unable to afford a car are all limited to older areas of the city and major bus routes that permit pedestrian or mass-transit movement. The urban structure of newer suburban areas implicitly requires the use of a car to travel to necessary services and shops as well as to be able to partake of the numerous community recreational services not so much by conscious design but by default. The reliance on the automobile also sometimes creates social tensions that would otherwise not be present or be far more limited. Parking problems in older areas of Hamilton have led to calls for a reduction in the creation of new affordable apartments in these neighborhoods, and neighbors in these areas often quarrel over parking rights, and the parking of cars on properties.

Many different groups are implicated in the continued expansion of low-density, energy-inefficient suburban areas. These include:

The Media: Movies, television and magazines continue to equate tranquil living conditions and social and economic success with suburban, low-density lifestyles. Much of the media seen in Hamilton-Wentworth and other parts of Ontario is produced in Los Angeles, the quintessential low-density, automobile-dependent society.

Local Governments: Local governments reinforce low-density suburbanization through regimented zoning regulations and standardized neighborhood plans that produce standardized subdivision patterns. Standardization as promoted through suburban municipal land-use regulations has resulted in new communities across North America being almost identical in their lay-out, aesthetics, and implicit opposition to pedestrians and public-transportation. Some municipalities have subsidized low-density developments by financing a large share of the municipal services costs associated with suburban land development.

Provincial/State Governments: Higher forms of government have also contributed to low-density neighborhoods inadequate for mass-transit through their lack of commitment to mass-transportation and through their steadfast support for highway construction. Local governments are often left to finance the lion's share of public transportation, an undesirable situation given the inevitable competition amongst municipalities to provide a low tax environment to businesses and residents. This lack of funding for public transit, combined with the availability of a vast and growing highway network, has increased public demand for automobile-dependent suburban developments.

Developers, Builders and Financial Institutions: Although builders and developers can legitimately be said to merely respond to existing housing demand and municipal regulations, more could probably be done to promote higher density forms of residential and industrial development. Banks and other financial institutions could reduce the trend towards standardization of suburban subdivision development by providing mortgages for non-traditional, higher-density forms of housing.

Consumers and the General Public: The greatest pressures for low-density residential and industrial development unfortunately come from the average household and average industrial firm. Industrial firms find that suburban locations are good locations for their operations because land is cheap, modern light-manufacturing processes and warehousing operations increasingly require one or two-story buildings instead of multi-story buildings, because industry is increasingly reliant on truck-transportation, and because industrial executives and managers often prefer "greenfield" sites. People often prefer suburban homes because they feel it's a better environment for young children, because suburban areas are perceived as offering more recreational facilities and quieter surroundings, and because homes of any given quality and size are assumed to be cheaper in suburban locations. Unfortunately, undesirable aspects of suburban locations, such as isolation and transportation problems during winter, unavailability of unskilled labor, long commuting times, and lack of diversity of building types, are rarely recognized for their true level of importance by the general public.

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